**Note Outline 24.1.1 – The Study of Light**

I. Astronomy is very concerned with \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ light.

A. Most of our understanding of the universe comes from studying \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

B. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ light, the light we can detect with our eyes, makes up a small part of the different types of energy known as \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

II. Electromagnetic Radiation

A. Electromagnetic radiation includes:

i. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Rays (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_)

ii. \_\_\_-Rays (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_)

iii. \_\_\_\_\_\_\_\_\_\_\_-\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Rays (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_)

iv. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (ROYGBIV)

v. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Radiation (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_)

vi. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_)

vii. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_)

B. Electromagnetic Spectrum:

C. All EM energy, regardless of wavelength, travels through the vacuum of space at the ‘speed of light’ (c) = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_km/s or \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ mi/s.

i. In ONE DAY (24hrs.), light travels ≈ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_miles.

D. EM Radiation has properties of both a \_\_\_\_\_\_\_\_\_\_\_\_\_\_ and a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

i. Wave Nature: EM radiation is a pattern of oscillating (alternating) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ fields.

a. Wavelength (λ): The length between successive \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. See diagram below:

b. Frequency (f): The number of waves passing in \_\_\_\_\_\_\_\_\_\_\_. Measured in \_\_\_\_\_\_\_\_\_\_\_\_\_(Hz). 1Hz = 1 wave/second.

c. f λ = c, thus:

f = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

λ = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

d. λ is inversely proportional to f.

ii. Particle Nature: a “light” beam can be thought of as a stream of tiny, massless energy packets called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

a. Photons can be thought of as extremely small bullets fired from a machine gun.

b. Photons can \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ on matter with a force called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. (ex. Comet tails point away from the sun due to this force).

c. Short λ = more energetic photons.

Ephoton is inversely proportional to λ.